large steps; while these may occur, minute heritable changes are more frequent. . . . Evolution according to the typical Darwinian scheme, through the occurrence of many small variations and their guidance by natural selection, is perfectly consistent with what experimental and paleontological studies show us; to me it appears more consistent with the data than does any other theory.

Many believers in mutation have been needlessly befuddled by the diverse meanings of "variations" as used by Darwin and De Vries. Darwin included in his "individual variations" both the "fluctuating varieties" and the "mutations" of De Vries. Phenotypically they can not even now be distinguished. De Vries himself candidly admits that this was Darwin's attitude, thus proving himself more clear-sighted than many of his followers. All that Darwin needed for his purpose was proof of variations that are heritable, and these are found in mutations, be they large or small.

Just as mendelism has to do with the *mechanism* and not the *fact* of heredity, so the mutation theory deals with the *nature* and not the *fact* of variations. Neither, in my opinion, has any implication that is antagonistic to the theory of natural selection.

The statement has often been made that natural selection "originates nothing" because it does not explain the origin of variations. I must confess to scant patience with this point of view. As well say that the sculptor does not make the statue because he does not manufacture the marble or his chisel; or that the worker in mosaic originates nothing because he does not make the bits of stone which he assembles in his design!

The material corresponding to the bits of stone in the mosaic is furnished by heredity and variation, and its quantity by geometrical ratio of increase. Natural selection acts in selecting and putting together this material in the formation of new species. Thus, in a true sense, it seems evident that something new has appeared—something that *is* but *was not*.

Another favorite figure, introduced I believe by De Vries, is "Natural selection acts only as a sieve" determining which forms shall be retained and which shall be discarded. This also seems to me to fall short of a complete statement of the truth. If the material subjected to the sifting process be regarded as changing with each generation by the addition of variations, or mutations if you prefer, some of which are favorable to a nicer adjustment of the species to its environment; the figure would be more nearly correct. To make it complete, however, the *mesh* of the sieve must change from generation to generation so that a quantitative variation which would be preserved in one generation would be discarded in a later one. But in this case natural selection would do more than a sieve could do. It would combine a number of favorable variations in the production of something new, a *new species!*

In conclusion it seems to me that we are justified in maintaining that Mendelism and the mutation theory, while forming the basis of the most brilliant and important advances in biological knowledge of the last half century, have neither weakened nor supplanted the Darwinian conception of the "Origin of species by means of Natural Selection."

C. C. NUTTING

SCIENTIFIC EVENTS

PROFESSOR CALMETTE ON A VACCINE FOR TUBERCULOSIS

THE Paris correspondent of the *London Times* reports that the *Petit Journal* publishes an interview with Professor Calmette, subdirector of the Pasteur Institute, which indicates that progress has been reached in the long struggle of the medical profession to find a cure for the ravages of tuberculosis. Professor Calmette was careful to tell his interviewer not to proclaim too widely that a cure has been found. "We are only at the dawn," he said. "The possibilities are immense, I can assure you, but we have still much work before us . . . in following the pathway which now lies open before us and which will lead us perhaps to a splendid realization of our hopes. Hope is now permissible."

Professor Calmette then gave an account of the results of his researches and those of Dr. Guérin, which proved that cattle and monkeys could be given immunity. A vaccine has been found for cattle. Experiments lasting over many months have given results said to be of importance.

Professor Calmette stated that in a certain stable they placed five known tuberculous cows. With them were housed ten heifers, four of which had not been given an effective vaccine, and the other six had been vaccinated. The trial lasted for thirty-four months, some of the cattle being revaccinated each year. At the end of the time, when the beasts were slaughtered, it was found that of the four unvaccinated heifers three showed advanced tuberculosis. Of the six vaccinated beasts the two which had only once been vaccinated showed distinct signs of the disease, but the four animals which had been vaccinated three times, although they had been in constant company with the tuberculous companions for thirty-four months, showed no trace of the disease. Further experiments on a large scale are now going on.

To find out whether this vaccine is capable of being applied to man experiments will be necessary on chimpanzees and anthropoid apes. These animals do not take kindly to temperate climates, and Professor Calmette and his collaborators have therefore decided to build an experimental laboratory in French Guinea. The Pasteur Institute has obtained the concession of Rooma Island, four miles from Konakry, for their researches, and the governor of Western Africa has put at the institute's disposal from the 1921 budget the sum of about £6,000, with which the laboratories will be constructed. The researches of the scientific missions will take some years, and the estimated expenditure is £5,000 a year.

AWARDS OF THE PARIS ACADEMY OF SCIENCES

According to the report in *Nature* the prizes awarded by the Paris Academy include the following:

Mathematics.—Grand prize of the mathematical sciences to Ernest Esclangon, for his memoir entitled "New Researches on Quasi-periodic Functions"; the Poncelet prize to Elie Cartan, for the whole of his work; the Francœur prize to René Baire, for his work on the general theory of functions.

Mechanics.—A Montyon prize to Stéphane Drzewiecki, for his book on the general theory of the helix, with reference to marine and aerial propeller-blades; the de Parville prize to Jean Villey, for his work on internal-combustion motors.

Astronomy.—The Lalande prize to Léopold Schulhof, for his revision of the catalogue of the proper motions of 2,641 stars; the Valz prize to Ernest Maubant, for his work on the calculation of the perturbations of comets; the Janssen medal to William W. Coblentz, for his work on the infra-red radiation of terrestrial sources and of stars; the Pierre Guzman prize between François Gonnessiat (5,000 francs), for his work on the photography of the minor planets; René Jarry-Desloges (5,000 francs), for his physical observations on the planets, especially Mars, and Joanny-Ph. Lagrula (4,000 francs), for his work on the rapid identification of the minor planets.

Geography.—The Delalande-Guérineau prize to Georges Bruel, for his explorations and publications relating to French Equatorial Africa; the Tchihatchef prize to Auguste Chevalier, for his explorations in Africa and Indo-China; the Binoux prize to Marcel Augiéras, for his work in the western Sahara.

Navigation.—The prize of 6,000 francs between Fernand Gossot (4,000 francs), for his treatise on the effects of explosives, Pierre de Vanssay de Blavous (1,500 francs), for the whole of his work, and René Risser (500 francs), for his work on ballistics.

Physics.—The L. La Caze prize to Georges Sagnac, for the whole of his work in physics; the Hébert prize to Léon Bouthillon, for his work on wireless telegraphy; the Hughes prize to Frédéric Laporte, for his work on electrical standards and the photometry of electric lamps; the Clément Felix foundation to Amédée Guillet, for his researches on chronometry.

Chemistry.—The Montyon prize (unhealthy trades) to Léonce Barthe, for his work on the hygiene of workshops; the Jecker prize (5,000 francs) between Henri Gault, for his work in organic chemistry, and Henri Hérissey, for his researches on the glucosides of plants; the L. La